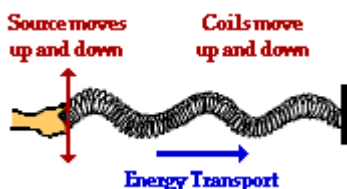


## Activity #1



### Title: An Investigation into Transverse Waves (Teacher's annotated (in red font) version)

Note to students: All answers and diagrams are to be made on a separate answer sheet. Make no marks on this paper.

(Lab teams of three students are required for this activity.)

### National Standards addressed: *INTERACTIONS OF ENERGY AND MATTER*

Waves, including sound and seismic waves, waves on water, and light waves, have energy and can transfer energy when they interact with matter

#### Purpose:

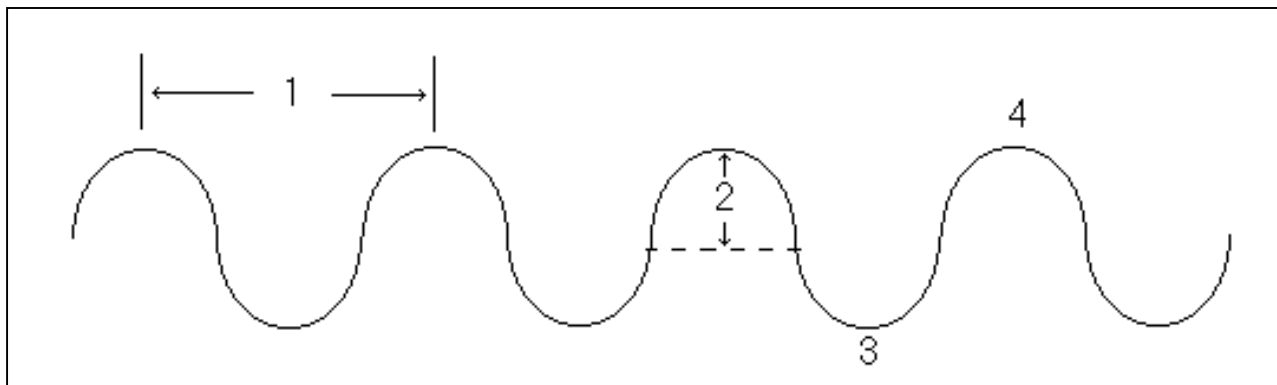
- To become familiar with the nomenclature associated with transverse waves
- To visualize the processes by which waves carry energy from one point to another

**Materials:** long (small diameter) spring, meter stick, string (5 cm)

#### Materials Sources:

- Long (small diameter) spring,: Frey Scientific, 100 Paragon Parkway, P.O. Box 8101, Mansfield, OH 44903---2002 catalogue, pg. 761, **Economy Wave Demonstrator Set**, # 15578650, \$11.35
- Meter stick: Frey Scientific, 100 Paragon Parkway, P.O. Box 8101, Mansfield, OH 44903---2002 catalogue, pg. 691, **Hardwood Meter Sticks**, # 15015366. \$2.95

**Procedure:** 1-4. Reproduce the diagram below on your answer sheet. Use your textbook or perform an Internet search (<http://www.glenbrook.k12.il.us/gbssci/phys/Class/waves/u10l2a.html>) to label the various components of the transverse wave. (Answers #'s 2, 3 & 4 below can be obtained directly from the diagram on the website above. The answer to #1 can be answered from reading the text below the diagram on the website.) 1. wavelength 2. amplitude 3. trough 4. crest



5. To see if you understand the concept, draw a wave that has TWICE the wavelength of the one you diagrammed in #1-4 above.
6. Draw a wave that has one half the amplitude of your first wave.

7. Now you are going to create a wave like the ones diagrammed above. Place the long, small diameter spring on the floor. Have one of your partners hold one end while you snap the opposite end of the spring away from you about 20 cm and then back again to the starting position. Do this about twice every second continuously. You are producing a **transverse wave** much like the one diagrammed above. Using a meter stick, have the third member of your group measure and record the wavelength in centimeters. (Because the waves are moving, students will have to **ESTIMATE the approximate distance from one crest to another.**)
8. Now snap the spring about four times each second continuously. Measure and record the new wavelength. (This measurement should be roughly one-half of that obtained in #7 above.)
9. The *frequency* of a wave is the number of waves that are produced in one second. From your observations in # 7 & 8 above, complete the following sentence: As the frequency of a wave increases, its wavelength \_\_\_\_\_. (increases, decreases, remains about the same size) (**decreases**)
10. Tie a small, white string to one coil near the center of your spring. Create a wave that travels down the spring as in #8 above. Describe the motion of the string as the energy of the wave passes down the spring. (i.e., The string does not move at all. The string moves in the same direction (parallel to) as the wave. The string movement is perpendicular ( 90°) to the direction of the wave.) (Students should be able to determine that the string moves perpendicularly to the direction that the wave is traveling.)
11. As the wave travels from one end of the spring to the other, do the actual coils of the spring move from one end to the other? This is an important procedure in this activity as it shows the student that although the waves they are producing travel down the length of the spring, the actual coil with the string attached does not. The coil does move perpendicularly to the direction of the wave. The wave carries the **ENERGY** of the moving hand from one end of the spring to the other, but does not carry the material itself. This can be compared to a ball floating in the ocean near the shoreline. The ball rises and drops as the wave's crest and trough passes by, but the ball itself remains in nearly the same offshore position.
12. Describe what you have to do to create a wave that travels down the spring with twice the **AMPLITUDE** of the first. (The student should mention that one's hand (which creates the motion in the spring) must move through a greater distance when initially snapping the spring to create a larger amplitude.)

**TECHNOLOGY INTEGRATION:** The following websites provide animated graphics to enhance the content presented in the activity above:

- The animations below demonstrate both types of wave and illustrate the difference between the motion of the wave and the motion of the particles in the medium through which the wave is traveling.

[HTTP://WWW.GMI.EDU/~DRUSSELL/DEMOS/WAVES/WAVEMOTION.HTML](http://www.gmi.edu/~drussell/demos/waves/wavemotion.html)

- A “check your understanding” quiz reinforces the initial nomenclature covered at the beginning of this lab activity:

<http://www.gmi.edu/~drussell/Demos/waves/wavemotion.html>

- This interactive website allows the student to adjust the frequency and the amplitude of a transverse wave and to observe the effects, if any, on the wavelength:

<http://surendranath.tripod.com/Twave/Twave01.html>